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FRV G.B. REED Assemblage Survey of Hecate Strait January 27–February 18, 1986

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by

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ABSTRACT

Foucher, R. P., A. V. Tyler, M. W. Saunders, and D. H. Janusson. 1988. FRV G. B. REED assemblage survey of Hecate Strait, January 27 - February 18, 1986. Can. Data Rep. Fish. Aquat. Sci. 708: 180 p.

During January-February 1986, the FRV G.B. REED completed its portion of a two-vessel survey of groundfish species occupying the shelf area of Hecate Strait and Moresby Gully. The purpose was to collect data which can be used to determine the makeup and distribution of species assemblages, as a first step towards development of an ecological basis for mixed-species stock assessment. This report contains details of the cruise, including weight caught and length frequency by species. Sixty-eight usable hauls were completed. Additional data collected included plankton samples, water temperatures, stomach samples and surficial-sediment samples.

RÉSUMÉ

Foucher, R. P., A. V. Tyler, M. W. Saunders, and D. H. Janusson. 1988. FRV G. B. REED assemblage survey of Hecate Strait, January 27 - February 18, 1986. Can. Data Rep. Fish. Aquat. Sci. 708: 180 p.

En janvier et février 1986, le G. B. REED a terminé sa partie d'un relevé effectué à deux bateaux, des espèces de poisson de fond habitant le secteur de la plate-forme du détroit d'Hécate et du passage de Morseby. Le but était de recueillir des données dont on pourrait se servir pour déterminer la constitution et la répartition des groupements d'espèces, comme première étape en vue de constituer une base écologique pour l'évaluation des stocks à espèces mixtes. Le rapport contient des détails sur l'expédition, y compris le poids capturé et la fréquence des longueurs par espèce. On a réalisé soixante-huit coups de chalut utilisables. Parmi les autres données recueillies, figurent des échantillons de plancton, des températures de l'eau, des échantillons du contenu stomacal et des échantillons de sédiments superficiels.

INTRODUCTION

This work was carried out as part of the Hecate Strait Project to develop an ecological basis for alternative, mixed-species assessment techniques. The project was started in May 1984 with the first two-vessel survey involving the FRV G. B. REED and the FV ARCTIC OCEAN (Westrheim et al. 1984, Fargo et al. 1984). Two later cruises (June and September-October 1985) of the FRV G. B. REED collected further data on groundfish food-resource division (Saunders et al. 1986). The cruise reported here, which represents the winter component of a seasonal comparison, was coordinated with that of the FV DOUBLE DECKER, a commercial trawler under charter during the same period. Results of the FV DOUBLE DECKER cruise are reported in Fargo and Davenport 1986.

This work has two main components. The first is to provide synoptic survey data that would enable the design of maps to display changes in relative abundance of species available to trawlers. The strategy is based on observations that the mix of species differs between sites in any given region of continental shelf. Conversely, there are usually strong similarities in the species compositions among some sites. These fairly homogeneous groupings are sometimes termed "assemblages".

The aim of the Food-resource-division component of the Hecate Strait Project is to detect patterns of food-resource division among abundant groundfish species in Hecate Strait. These patterns are revealed through analysis of stomach-content samples from trawl-caught groundfish species. Samples of benthic infauna and epifauna, collected concurrently, provide a measure of prey availability for a portion of the food resources and will be used to explain the observed patterns and any changes occurring in them over time.

Both stomach and benthic samples, collected from four areas of Hecate Strait deemed to be representative of four major groundfish assemblages, were preserved for later laboratory analysis. Staff of the Ecology section of the Institute of Ocean Sciences (Patricia Bay, B.C.) collected the benthic samples.

MATERIALS AND METHODS

FISHING VESSEL

The FRV G. B. REED is a 775-ton side trawler powered with a 1000-hp diesel engine and equipped with a controllable-pitch propeller. Overall length is 177 ft (80m).

FISHING GEAR

Fishing gear consisted of a Yankee 36 trawl net connected to 2000-lb Brompton otter boards by 30-fath sweeplines. The groundline consisted of 7-in rubber discs strung on steel cable and suspended from the fishing line by 12 links of 1-in chain beckets at intervals of 24 in.

SURVEY DESIGN

Factors involved in the survey design were described in detail in the report of the first survey (Westrheim et al. 1984). Hecate Strait was divided into 10-nautical-mile blocks and each block was divided into 10 or 20-fath depth intervals. One trawl haul was scheduled at each depth interval with the shallower hauls generally being assigned to the FV DOUBLE DECKER. The FRV G. B. REED was assigned 66 of the trawling stations, from A2-6 to L6-10 (Figure 1; Table 1). More intensive sampling was done in one block (H4) to examine between-haul variability.

To facilitate a comparison of the assemblage maps produced by each vessel, both vessels occupied a number of stations at the intermediate depths. To further facilitate the comparison between vessels, two hauls by each vessel on the same day, were scheduled for a time during the study convenient to both vessels.

While the number of stations per block depth-stratum was determined in advance of the cruise, the selection of the specific location of each haul within a block depth-stratum was made by the vessel captain, who searched the appropriate area for trawlable bottom and decided whether a haul could be made.

CATCH PROCESSING

Catches were segregated by species into plastic tubs (ca. 50-kg capacity). Each was weighed to the nearest kg on a platform scale. When the catch of any species exceeded 7 full tubs, total weight was calculated from a subsample usually following the method of Westrheim (1967).

LENGTH FREQUENCIES

All fish species caught were measured to the nearest cm of fork length with two exceptions. Spiny dogfish were measured total length, with the tail bent down in line with the body. Ratfish were measured to the posterior edge of the third dorsal fin because of the high proportion of

ratfish which were missing portions of their tails. The relationship between total length and length to the posterior edge of the third dorsal fin is: total length = 6.1170 + (1.2033 X length to third dorsal); $R^2 = 0.96$ (Saunders et al. 1986). Squid were measured to the nearest cm of fork length.

For "large" catches (ca. >300) specimens) of individual species, sampling schemes were employed to reduce sampling time. Most schemes followed, or were modifications of, that reported by Westrheim (1967).

FECUNDITY

Ovaries from ripe females were required for an investigation of fecundity of Pacific cod. Ovaries were stored in Gilson's solution (equal parts acetic acid, chloroform and ethanol) for later analysis.

STOMACH SAMPLING

Stomach sampling was conducted at each of the four stomach-sampling areas (Figure 2). A detailed description of the stomach-sampling areas is presented in Saunders et al. (1986). The location and direction of the trawl hauls within each area was left to the discretion of the captain, with the stipulation that the haul could not duplicate any of the hauls made previously during the cruise.

Stomachs were sampled from the total catch of a minimum of two trawl hauls at each of the stomach-sampling areas. When time permitted, further hauls were sampled specifically to increase the sample size for infrequently occurring species such as halibut and skate. Stratified samples of ten stomachs, containing food, per 10-cm length interval for each species were taken. Stomachs were removed from the fish by cutting the esophagus as close as possible to the mouth and the intestine just posterior to the stomach. The stomachs were sealed in individual plastic bags (Whirlpak) with 10% buffered formalin in sea water. A label with cruise, haul, species and fish length (cm) was included. Records of individual fish lengths and the incidence of empty stomachs were kept. In the case of ratfish, the entire gut was preserved because of the short and poorly-defined stomach.

BENTHIC SAMPLING

The benthic infauna was sampled with a Smith-MacIntyre grab. Six benthic samples were collected from a central location within each of the stomach-sampling areas. From each grab sample, cores of approximately 100 g were removed and stored in plastic bags at 4 deg C. for particle-size analysis. The remainder of each sample was sieved through 1.0, 2.0, and 12.0-mm screens, and preserved in plastic bags with 10% buffered formalin.

Rose bengal dye was added to assist in later sorting. From the sixth grab three cores were preserved for possible future identification of smaller infauna and meiofauna not retained by the 1.0-mm screen. Time permitting, a further five grab samples were collected at locations widely distributed within each stomach-sampling area.

A sample of the epifauna was collected from each stomach-sampling area using an epibenthic sled towed for ten minutes. Material retained in the sled was preserved and stored for subsequent laboratory identification.

SURFICIAL SEDIMENTS

In order to more accurately map the bottom type within stomach-sampling area D, surficial-sediment samples, in addition to those discussed under BENTHIC SAMPLING, were collected. A Shipek grab, deployed at stations on the intersections of a grid of lines separated by one nautical mile was used to sample the sediment. The samples were frozen for later laboratory analysis of particle-size composition, to be conducted by staff of the Pacific Geoscience Center (Patricia Bay, B.C.). Samples from areas A, B and C were collected on previous cruises (Saunders et al. 1986).

WATER TEMPERATURES

Water temperatures were collected at selected stations with an expendable bathythermograph (XBT).

PLANKTON

Vertical plankton samples were collected with a 350-µm mesh SCOR net. The net was lowered to 1 m from the bottom and raised at approximately 1 m per second. Samples were preserved in 10% formalin in seawater for future processing.

RESULTS

GENERAL

A total of 69 trawl hauls were made of which 68 were deemed "usable" (Figure 3). The one "unusable" haul (haul 21) was disqualified due to the net

being torn. Detailed records of all hauls and catch weights by species are contained in Appendix table 1. An index to common and scientific names of all fish caught is contained in Appendix table 2. Fourteen of the scheduled station were not completed. Four additional and unscheduled stations were trawled successfully. Two hauls were made with the FV DOUBLE DECKER fishing alongside. These were both in block H407. Table 2 provides an inventory of hauls.

Total fish catch from usable hauls was 13,162 kg (estimated 42,984 specimens), comprising 58 species (Table 3). Principal species by weight were ratfish, English sole, Pacific cod and arrowtooth flounder -- 63% of the total catch. Principal species by numbers were English sole, ratfish, rex sole and arrowtooth flounder -- 64% of the total catch.

COMPARATIVE FISHING

A total of eight hauls were completed in a small area in the southern portion of block H4, six by the FRV G. B. REED and two by the FV DOUBLE DECKER (Fig. 4). Hauls 4-7 (each 30-min duration) were completed by the FRV G. B. REED within two days. Hauls 46-47 and 57-58 (each 20-min duration) were completed by the FRV G. B. REED and the FV DOUBLE DECKER respectively, over a period of about five hours. Catches of the 20-min hauls were multiplied by 1.5 for this comparison to standardize to 30-min. The range of depths was nine fath.

Species composition was reasonably similar (Figure 5, Table 4). Notable variations were in the English sole: haul 47 = 171 kg, haul 58 = 12 kg. Big skate and spiny dogfish, with a greater mean weight per fish, are not as reliable as indicators because a few fish can make a large difference. The 63 kg of big skate in haul 47 (extrapolated from the actual 42 kg caught in 20 min) represents only 4 specimens.

LENGTH FREQUENCIES

Lengths were recorded for a total of 39,622 individual fish. For most hauls, all specimens caught were measured. Catch sampling occurred for four species, including squid, in 13 hauls (Table 5). For example, in haul 11 the total catch of ratfish was 471 kg but only 250 kg (313 specimens) were sampled for length. The sample consisted of all ratfish sorted into the first two, middle two and last two full tubs. Estimated number caught was calculated as 590 = (471)(313)/(250).

Table 6 contains a page index to length frequencies, by species, by haul. Length frequencies for fish with stomachs containing food, empty stomachs, everted stomachs and for all fish measured are presented in Appendix tables 3, 4, 5, and 6 respectively.

FECUNDITY

Ovaries were collected from 54 Pacific cod for later analysis of fecundity. The length frequency of these fish is listed in Table 7 for Two Peaks and areas south of Two Peaks.

STOMACH SAMPLING

A total of 1,390 stomachs were preserved from 23 species of groundfish from 14 trawl hauls. The numbers of stomachs collected by species and haul are presented in Table 8. Analysis of stomach samples is to be carried out in the laboratory and be reported at a later date.

BENTHIC SAMPLING

Benthic-grab samples were collected and invertebrates preserved at stations described previously in Saunders et al. (1986). These results, after sample analysis by staff of the Pacific Geoscience Center, will be published later.

SURFICIAL SEDIMENTS

A total of 16 Shipek-grab samples were collected from stomach-sampling area D. The station locations and results of the particle size-analysis completed by the Pacific Geoscience Center (Patricia Bay, B.C.) are presented in Figure 6 and Appendix table 7. Stations 1, 4, 13 and 16 correspond to the four corners of area D.

WATER TEMPERATURES

Thirty-nine XBT casts were completed -- 5 in Queen Charlotte Sound and 34 in Hecate Strait (Fig. 7). Nine of these were located at standard oceanographic locations, the remainder were taken in conjunction with hauls, generally at the end of the haul. Locations and water temperatures are reported in Appendix table 8.

PLANKTON

Vertical plankton hauls were made at only one hydrographic station in Hecate Strait (Fig. 7, Appendix table 8).

MISCELLANEOUS

Sex was recorded for the 22 Pacific halibut from which stomach samples and otoliths were collected (Appendix table 9).

PERSONNEL

Pacific Biological Station

A. V. Tyler	January 27 - February 18
M. W. Saunders	January 27 - February 18
R. P. Foucher	January 27 - February 18
D. Adams	January 27 - February 7
J. Lucas	February 8 - 18

Pacific Geo-Science Center

D. Moore	January 27 - February 7
I. Ostrovsky	January 27 - February 7

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The authors would like to thank the master and crew of the FRV G. B. REED for their part in completing this survey. We would also like to thank Devona Adams and Jan Lucas for sampling assistance during the cruise as well as Doug Moore and Irina Ostrovsky for collecting sediment samples and processing them at the Pacific Geoscience Center.

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Table 1. Inventory of scheduled trawl stations by block and depth stratum, for the cruises to Hecate Strait of the FRV G.B. REED (R) January 27 - February 20, 1986 and of the FV DOUBLE DECKER (D), January 30 - February 19, 1986.

	Depth strata[a]										Total by vessel		
Block	1	2	3	4	5	6	7	8	9	10	D	R	Grand total
A-2	-	-	-	-	-	R	-				-	1	1
-3	-	-	D	D/R	R	-	-				2	2	4
B-1	D	D	D	D	R	R	R				4	3	7
-2	D	D	D	D	D/R	R	R				5	3	8
-3	D	D	D	D/R	R	R	-				4	3	7
C-2	D	-	-	-	-	-	-				1	-	1
-3	D	D	D/R	R	R	-	-				3	3	6
D-2	D	-	-	-	-	-	-				1	-	1
-3	D	D	D/R	R	-	-	-				3	2	5
-4	-	-	R	R	-	-	-				-	2	2
E-2	D	D	-	-	-	-	-				2	-	2
-3	D	D/R	R	-	-	-	-				2	2	4
-4	-	D	-	-	D/R	R	-				2	2	4
F-2	D	-	-	-	-	-	-				1	-	1
-3	D	D	D	-	-	-	-				3	-	3
-4	-	D	D	D	D	R	R				4	2	6
G-1	D	-	-	-	-	-	-				1	-	1
-2	D	-	-	-	-	-	-				1	-	1
-3	D	D	D/R	R	R	-	-				3	3	6
-4	-	-	-	D	D	D	D				4	-	4
H-2	D	-	-	-	-	-	-				1	-	1
-3	D	D/R	R	R	-	-	-				2	3	5
-4	-	-	-	-	R	R	R				-	3	3
I-2	D	-	-	-	-	-	-				1	-	1
-3	D	D	D	-	-	-	-				3	-	3
-4	D	D	D	D/R	R	R	R				4	4	8
-5	-	-	-	R	R	R	R[b]				-	5	5
J-2	D	-	-	-	-	-	-				1	-	1
-3	D	-	-	-	-	-	-				1	-	1
-4	D	D	-	D/R	R	R	-				3	3	6
-5	-	-	-	R	R	R	R				-	4	4
-6	-	-	-	-	-	-	-	-	R[b]	R[b]	-	2	2
K-3	D	D	D	D	D	-	-				5	-	5
-4	-	D	D	R	R	R	-				2	3	5
-5	-	-	-	-	-	R	R	R[b]			-	3	3
L-3	-	-	D	D	-	D	D				4	-	4
-4	-	-	-	D	D	D/R	R				3	2	5
-5	-	-	-	-	R	R	R	R[b]			-	4	4
-6	-	-	-	-	-	-	-	-	R[b]	R[b]	-	2	2
Total	23	19	20	23	20	18	12	3	2	2	76	66	142

[a] 1 = 10-19 fath, 2 = 20-29 fath, 8 = 80-99 fath, 9 = 100-119 fath, etc.
[b] Stations added in 1986 to block-strata in Moresby Gully.

Table 2. Inventory of usable hauls by block and depth stratum, schedules for or completed during the cruise of FRV G.B. REED to Hecate Strait, January 27 - February 18, 1986. (Block-depth strata in parenthesis were added during the cruise.)

Block-depth stratum[a][b]	Haul	Block-depth stratum	Haul	Block-depth stratum	Haul
A 2-6	18	(E 4-7)	34	J 4-4	not completed
3-4	19	(5-5)	35	-5	not completed
-5	not completed			-6	not completed
(-6)	20	F 2-1	8,19,10	5-4	61
		(4-5)	37	-5	62
B 1-5	15	-6	not completed	-6	49
-6	16	-7	36	-7	not completed
-7	17			6-9	65
2-5	11,12	G 3-3	39	-10	64
6	13	-4	40		
7	14	-5	38	K 4-4	51
3-4	24			-5	52
5	23	H 3-2	41	-6	53
6	21,22[c]	-3	42	5-6	50
		-4	43	-7	not completed
C 3-3	27	4-5	59	-8	not completed
4	25	-6	4	6-8	66
5	26	-7	5,6,7,57,58	9	69
D 3-3	28	I 4-4	1,2,3	L 4-6	54
4	29	-5	46	-7	55
4-3	not completed	-6	45	5-5	not completed
4	30	-7	44	-6	not completed
		5-4	not completed	-7	56
E 3-2	31	-5	60	-8	67
3	32	-6	48	6-9	not completed
4-5	33	-7	47	-10	68
6	not completed	-8	63		

[a]Block - A2 = block A2 as shown in Figure 1 etc.

[b]Depth strata - 1 = 10-19 fath, . . . 7 = 70-79 fath, 8 = 80-99 fath, 9 = 100.

[c]Haul 22 is a repeat of haul 21 which tore up.

Table 3. Total weight and numbers, by species, of fish specimens caught in usable hauls during the cruise of the FRV G.B. REED to Hecate Strait, January 27 - February 18, 1986.

Species	Weight (kg)	Number
Arrowtooth flounder	1163	4113
Butter sole	44	281
Curlfin sole	2	12
Dover sole	6	45
English sole	1904	10233
Flathead sole	98	1001
Pacific halibut	362	116
Pacific sanddab	382	3805
Petrale sole	88	166
Rex sole	671	4574
Rock sole	358	1155
Sand sole	8	83
Slender sole	13	193
Speckled sanddab	Trace	15
Starry flounder	2	1
Sebastes aleutianus	2	11
Sebastes alutus	92	287
Sebastes babcocki	78	57
Sebastes brevispinis	124	62
Sebastes diploproa	Trace	8
Sebastes elongatus	Trace	7
Sebastes entomelas	8	33
Sebastes flavidus	110	80
Sebastes maliger	4	6
Sebastes paucispinis	55	17
Sebastes pinniger	96	31
Sebastes proriger	2	73
Sebastes reedi	Trace	1
Sebastes ruberrimus	13	5
Sebastes variegatus	Trace	2
Sebastes zacentrus	Trace	1
Sebastolobus alascanus	3	15
Eulachon	9	667
Greenlings	1	3
Pacific hake	2	4
Pacific herring	1	18
Lingcod	757	557
Pacific cod	1250	3857
Pacific tomcod	5	60
Poachers	5	232
Sablefish	18	75
Salmon	5	2
Sandlance	Trace	2

Table 3 (cont'd)

Species	Weight (kg)	Number
Sculpins	Trace	19
Shad	1	2
Shiner perch	40	1548
Walleye pollock	44	453
Ratfish	3966	8657
Big skate	705	79
Black skate	1	2
Spiny dogfish	664	258
Total	13162	42984

Table 4. Comparison of catches[a] (kg) from eight hauls made in the southern portion of block H4 during the cruises to Hecate Strait of the FRV G.B. REED, January 27 - February 18, 1986, and the FV DOUBLE DECKER, January 30 - February 19, 1986.

Haul no.[b]	6	57	5	46	4	47	58	7
Vessel[c]	R	R	R	D	R	D	R	R
Depth (fath)[d]	70	70.5	70.5	71	69.5	76	74.5	78.5
Date	Jan. 31	Feb. 13	Jan. 30	Feb. 13	Jan. 30	Feb. 13	Feb. 13	Jan. 31
Start time (PDT)	8:29	8:29	15:18	12:10	13:40	13:21	9:34	14:43
Duration (min)	30	20	30	20	30	20	20	30
Species:[e]								
Arrowtooth flounder	7	13.5	2	1.5	16	16.5	1.5	19
English sole	34	37.5	11	-	60	171	12	18
Flathead sole	-	-	-	-	-	-	Trace	1
Pacific halibut	-	-	11	-	5	-	6	17
Petrale sole	9	Trace	1	-	27	7.5	3	13
Rex sole	20	21	5	7.5	14	58.5	9	6
Sebastes paucispinus	2	-	-	-	-	-	-	17
S. pinniger	-	-	-	-	-	-	-	2
S. ruberrimus	-	-	-	-	-	-	12	5
Pacific herring	1	Trace	-	-	-	Trace	Trace	Trace
Lingcod	2	10.5	13	Trace	9	3	Trace	18
Pacific cod	28	9	11	7.5	13	4.5	15	44
Shiner perch	1	4.5	1	10.5	2	15	Trace	Trace
Walleye pollock	Trace	Trace	-	-	-	3	Trace	1
Ratfish	Trace	3	Trace	27	1	3	1.5	4
Big skate	14	-	-	27	-	63	19.5	-
Spiny dogfish	26	10.5	26	-	57	6	21	28
Total	144	109.5	81	80.0	204	351	100.5	193

[a]Catches standardized to 30-minute haul duration.
[b]Hauls ordered from west to east - see Figure 4.
[c]Vessel: D = FV DOUBLE DECKER, F = FRV G.B. REED.
[d]Depth is mean of depths at beginning and end of haul.
[e]Species with no more than a trace catch in any haul excluded.

Table 5. Calculated number of specimens caught, by species, for hauls in which all specimes caught were not enumerated or measured during the cruise of the FRV G.B. REED to Hecate Strait, January 27-February 18, 1986.

Haul no.	Species	Weight (kg)		Numbers		
		Total	Sample	Sample	Total	Sample
4	squid	21	5	102	428	1/4 T.C.
5	squid	10	5	160	320	1/2 T.C.
6	squid	14	3	75	350	1/4 T.C.
7	squid	14	4	99	347	1/4 T.C.
35	squid	14	3	54	252	1/4 T.C.
43	squid	21	5	81	340	1/4 T.C.
44	squid	8	4	87	174	1/2 T.C.
45	squid	30	7	163	699	1/4 T.C.
11	ratfish	471	250	313	590	6 tubs
19	ratfish	597	298	876	1755	1/2 T.C.
20	ratfish	845	423	662	1322	1/2 T.C.
15	arrowtooth flounder	74	37	231	462	1/2 T.C.
36	rex sole	359	139	831	2146	3 tubs

[a]T.C. = total catch

Table 6. Page number index by species and length frequency type for fish measured during the cruise of the FRV G.B. REED to Hecate Strait, January 27 - February 18, 1986.

Species	Length frequency type			
	Full	Empty	Everted	Total catch
Flatfish				
Arrowtooth flounder	78	91	-	146
Butter sole	80	96	-	163
Curlfin sole	80	-	-	174
Dover sole	80	-	-	168
English sole	81	95	-	169
Flathead sole	80	93	-	159
Pacific halibut	84	94	-	161
Pacific sanddab	82	93	-	143
Petrale sole	83	93	-	153
Rex sole	85	94	-	155
Rock sole	86	93	-	164
Sand sole	80	96	-	174
Slender sole	-	-	-	167
Speckled sanddab	82	96	-	145
Starry flounder	-	96	-	163
Rockfish				
Sebastes aleutianus	-	-	-	136
S. alutus	-	-	-	136
S. babcocki	-	-	-	137
S. brevispinis	-	-	-	137
S. diploproa	-	-	-	138
S. elongatus	-	-	-	138
S. entomelas	-	-	-	138
S. flavidus	76	90	-	139
S. maliger	-	-	-	139
S. paucispinis	76	90	97	140
S. pinniger	-	90	-	140
S. proriger	-	-	-	141
S. reedi	-	-	-	141
S. ruberrimus	-	-	97	141
S. variegatus	-	-	-	141
S. zacentrus	-	-	-	142
Sebastolobus alascanus	-	-	-	142
Roundfish				
Eulachon	75	89	-	112
Greenlings - kelp	-	-	-	127
- masked	-	-	-	127
Lingcod	77	89	-	128
Pacific cod	73	88	-	113
Pacific hake	-	-	-	121

Table 6 (cont'd)

Species	Length frequency type			Total catch
	Full	Empty	Everted	
Pacific herring	-	-	-	111
Pacific sandlance	-	-	-	121
Pacific tomcod	-	-	-	121
Poachers - northern spearnose	-	-	-	135
- sturgeon	-	-	-	135
Sablefish	-	-	-	126
Salmon	-	-	-	111
Shad	-	-	-	111
Sculpins - dusky	-	-	-	134
- great	-	-	-	134
- northern	-	-	-	134
- Pacific staghorn	-	-	-	134
- roughback	-	-	-	134
- roughspine	-	-	-	135
- threadfin	-	-	-	134
Shinner perch	-	-	-	125
Walleye pollock	75	-	-	122
Selachii				
Big skate	71	87	-	105
Black skate	71	-	-	104
Ratfish	72	-	-	106
Spiny dogfish - male	69	87	-	98
- female	70	87	-	100
- unsexed	-	-	-	104

Table 7. Length frequency, by area, of Pacific cod from which ovaries were collected and preserved during the cruise of the FRV G.B. REED to Hecate Strait, January 27 - February 18, 1986.

Fork length (cm)	Two Peaks	South of Two Peaks
53	1	-
54	1	-
55	0	-
56	1	-
57	2	-
58	2	-
59	2	-
60	1	-
61	1	1
62	3	0
63	1	1
64	0	2
65	3	1
66	3	1
67	3	4
68	2	0
69	2	2
70	2	2
71	1	0
72	1	0
73	0	0
74	1	1
75	1	-
76	2	-
77	1	-
78	0	-
79	0	-
80	1	-
81	0	-
82	0	-
83	1	-
Total	39	15

Table 8. Number of stomachs collected and preserved by species, haul, trophic analysis area, block and depth stratum during the cruise of the FRV G.B. REED to Hecate Strait, January 27 - February 18, 1986.

Haul	1	2	3	Total	4	5	6	7	Total	8	9	10	Total	11	12	13	14	Total	62[a]	Total
Trophic area	D	D	D	D	C	C	C	C	C	B	B	B	B	A	A	A	A	A		
Block	I4	I4	I4		H4	H4	H4	H4		F2	F2	F2		B2	B2	B2	B2			
Depth stratum	4	4	4		6	7	7	7		1	1	1		5	5	6	7			
Arrowtooth flounder	5		3	8	35	18	24	14	91					31	28	35	33	127		226
Curlfin sole			1	1																1
Dover sole					1				1											1
English sole	52	38	45	135	20	21	20	20	81		1		1	9	20	22		51		268
Flathead sole								11	11											11
Pacific halibut	1	2		3	2	3		2	7	1		1	2	2				2		14
Petrale sole			2	2	21	3	11	11	46											48
Rex sole	6		10	16	21	17	24	20	82					17	1	7	1	26		124
Rock sole	6		2	8						1	7	1	9			1		1		18
Sand sole											5		5							5
Speckled sanddab										1	1		2							2
Pacific sanddab	23	25	20	68										1				1		69
Butter sole			2	2																2
Sebastes flavidus																1	17	18		18
S. paucispinis								1	1											1
Eulachon																10		10		10
Lingcod	1	1		2	7	2	3	1	13								1	1		16
Pacific cod	20	20	19	59	21	22	23	22	88	2	2		4	19	7	2	10	38	62	251
Walleye pollock	10			10			1	26	27					2		1		3		40
Black skate																2		2		2
Ratfish	1			1	28	4	2	10	44					41	40	45	26	152		197
Big skate	1	7	7	15										6				6		21
Male spiny dogfish						3	2		5						1	2		3		8
Female spiny dogfish					14	7	5	7	33							3		3		36
Total	126	93	111	330	121	101	113	145	530	5	16	2	23	128	97	131	88	444	62	1389

[a]An extra sample of Pacific cod stomachs was taken outside of the designated stomach sampling area.

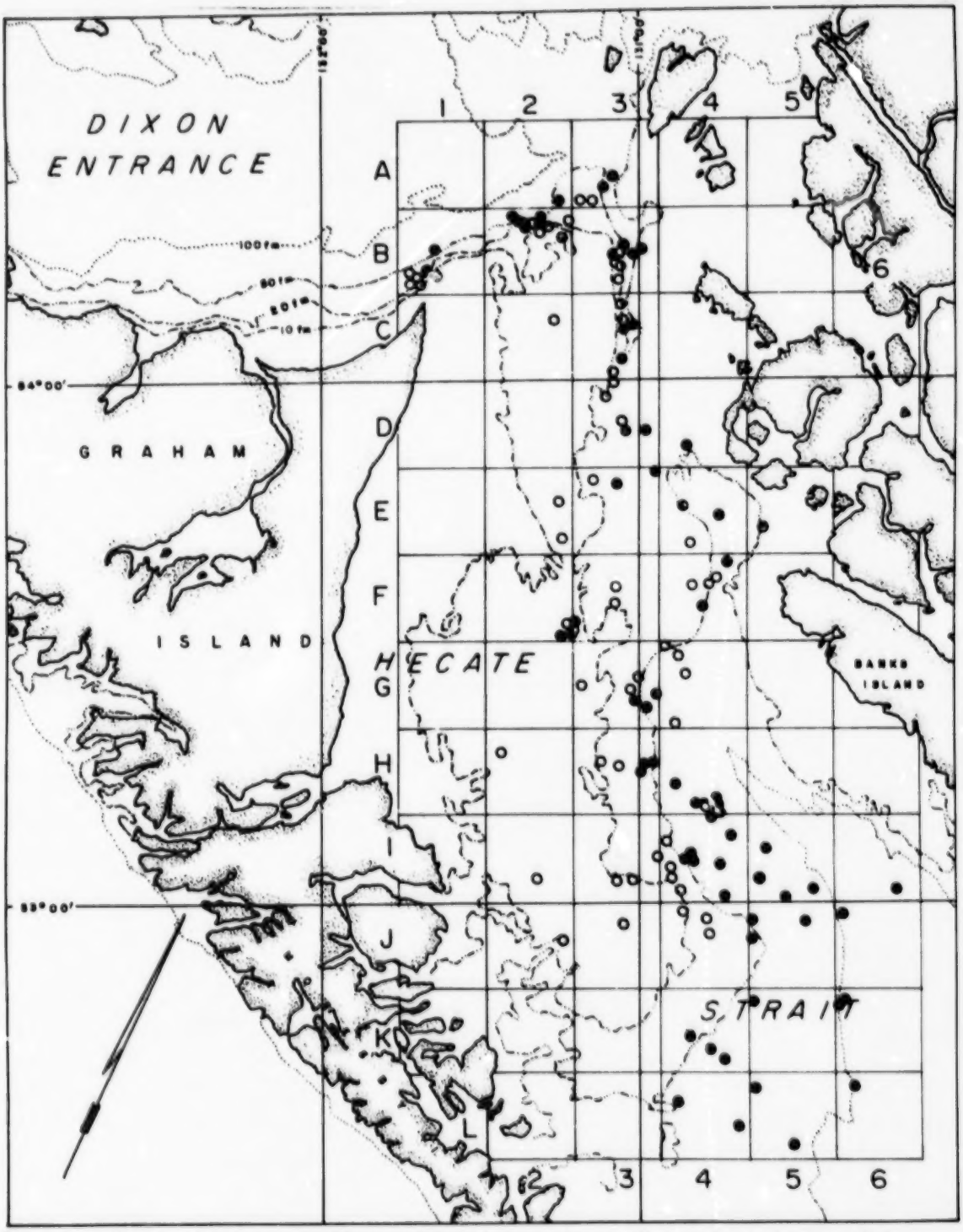

Fig. 1. Chart showing sampling grid and locations of trawl hauls completed during the combined surveys to Hecate Strait of the FRV G.B. REED, January 27 - February 18, 1986 and the FV DOUBLE DECKER, January 30 - February 19, 1986.

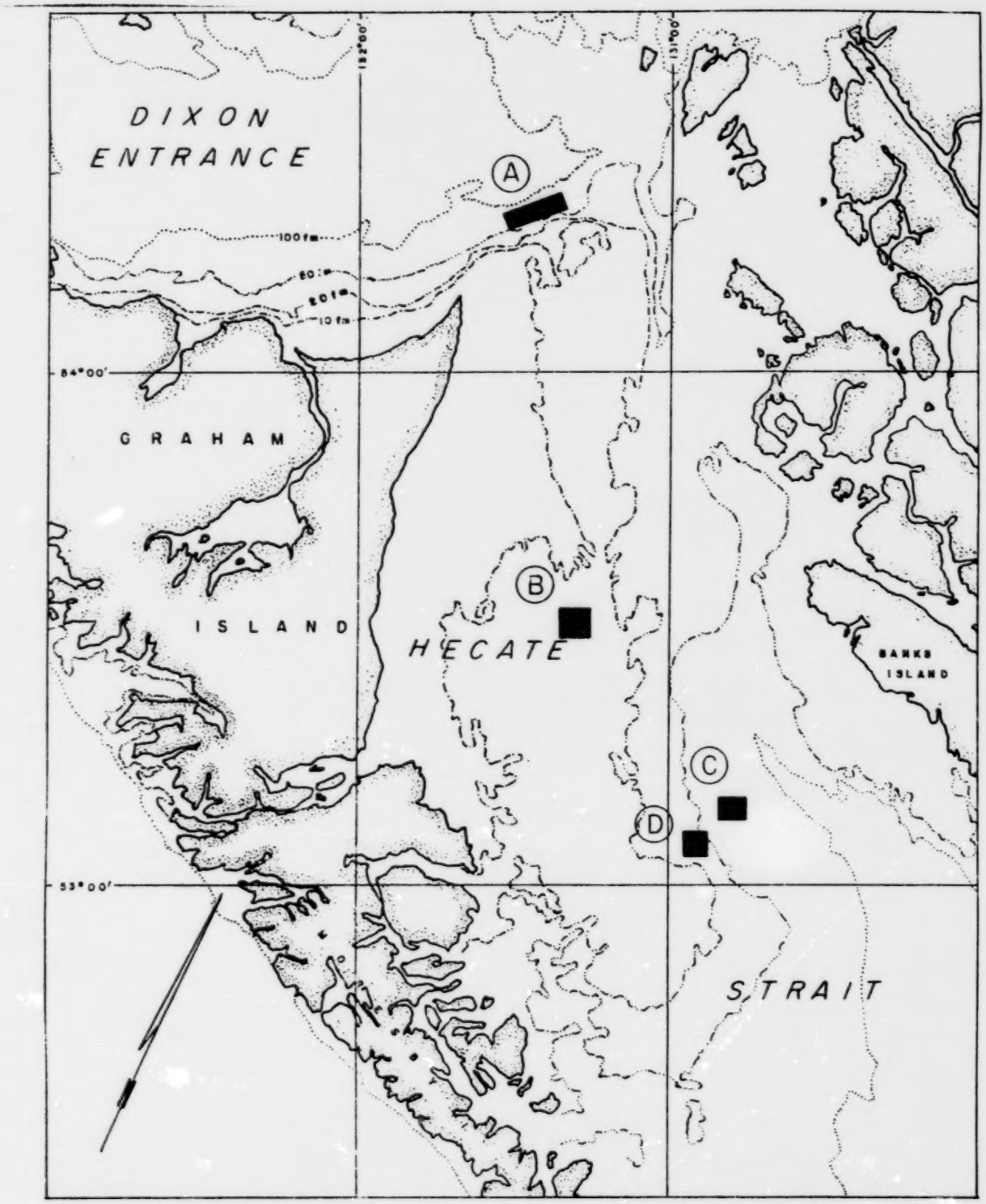

Fig. 2. Chart showing food-resource division study stomach-sampling sites occupied during the cruise of the FRV G.B. REED to Hecate Strait, January 27 - February 18, 1986.

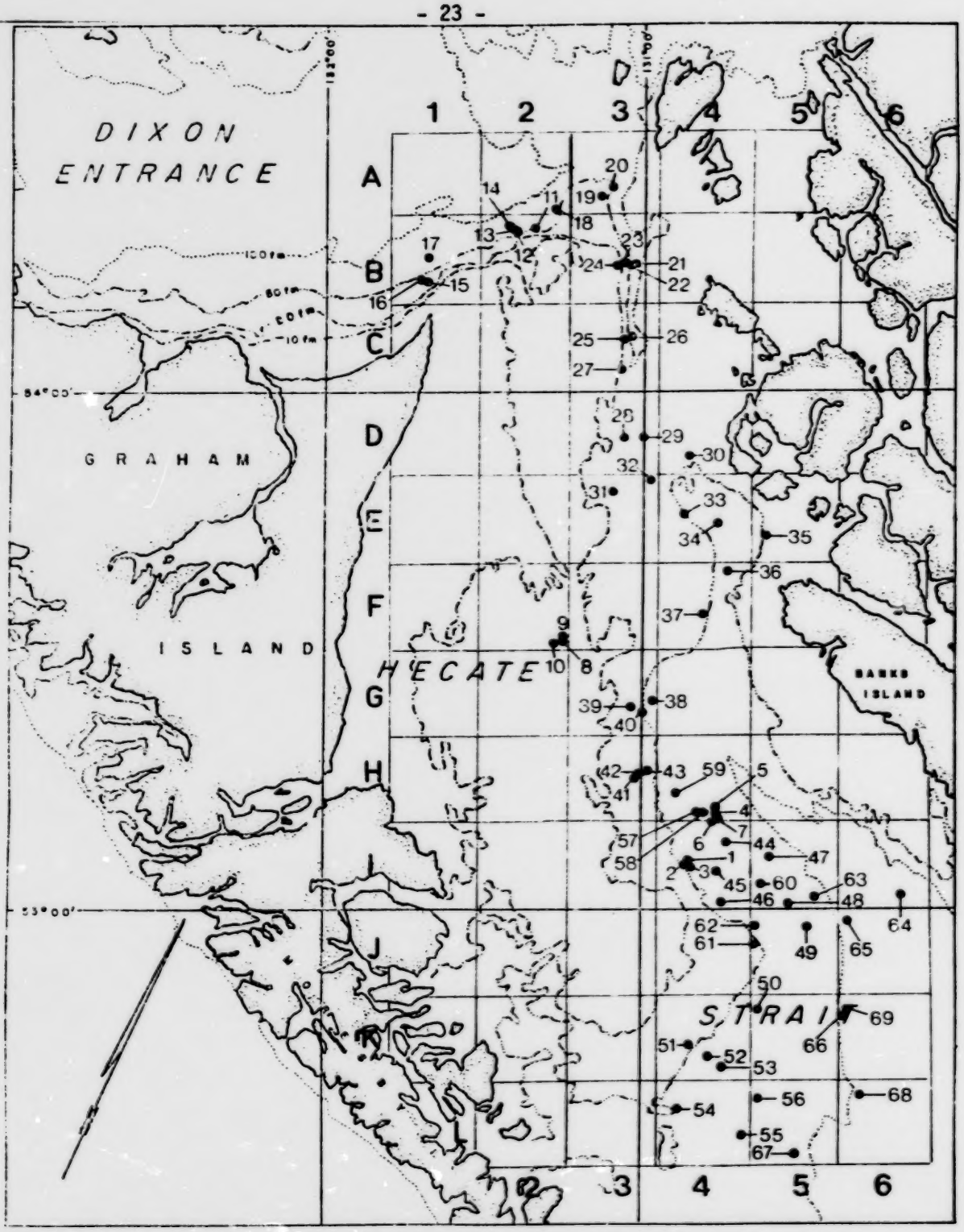

Fig. 3. Chart showing sampling grid and locations of trawl hauls completed during the cruise of the FRV G.B. REED to Hecate Strait, January 27 - February 18, 1986.

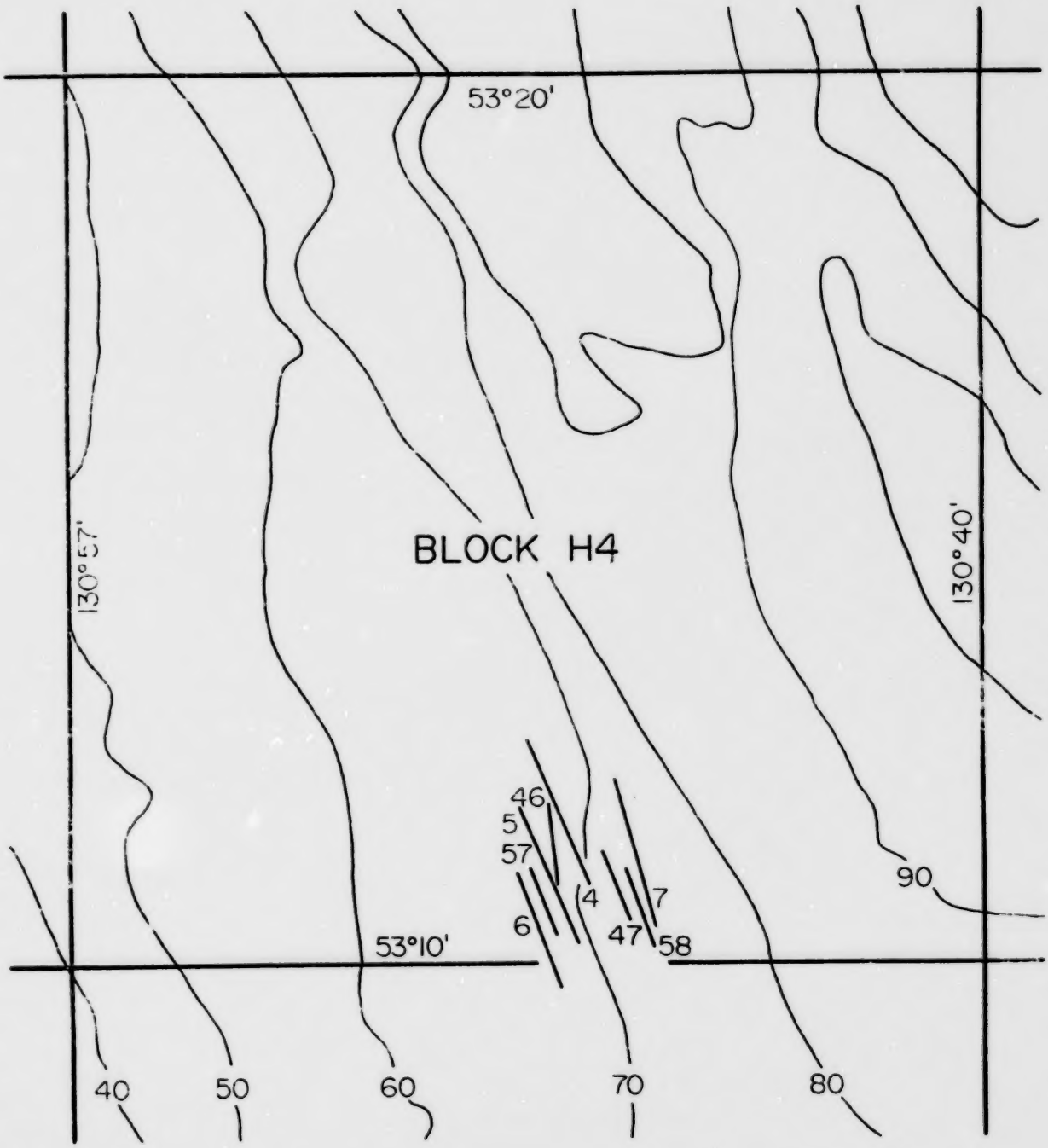

Fig. 4. Locations of eight trawl hauls made in the southern portion of block H4, in Hecate Strait. Hauls 4-7 and 57-58 - FRV G.B. REED, January 27 - February 18, 1986. Hauls 46-47 - FV DOUBLE DECKER, January 30 - February 19, 1986.

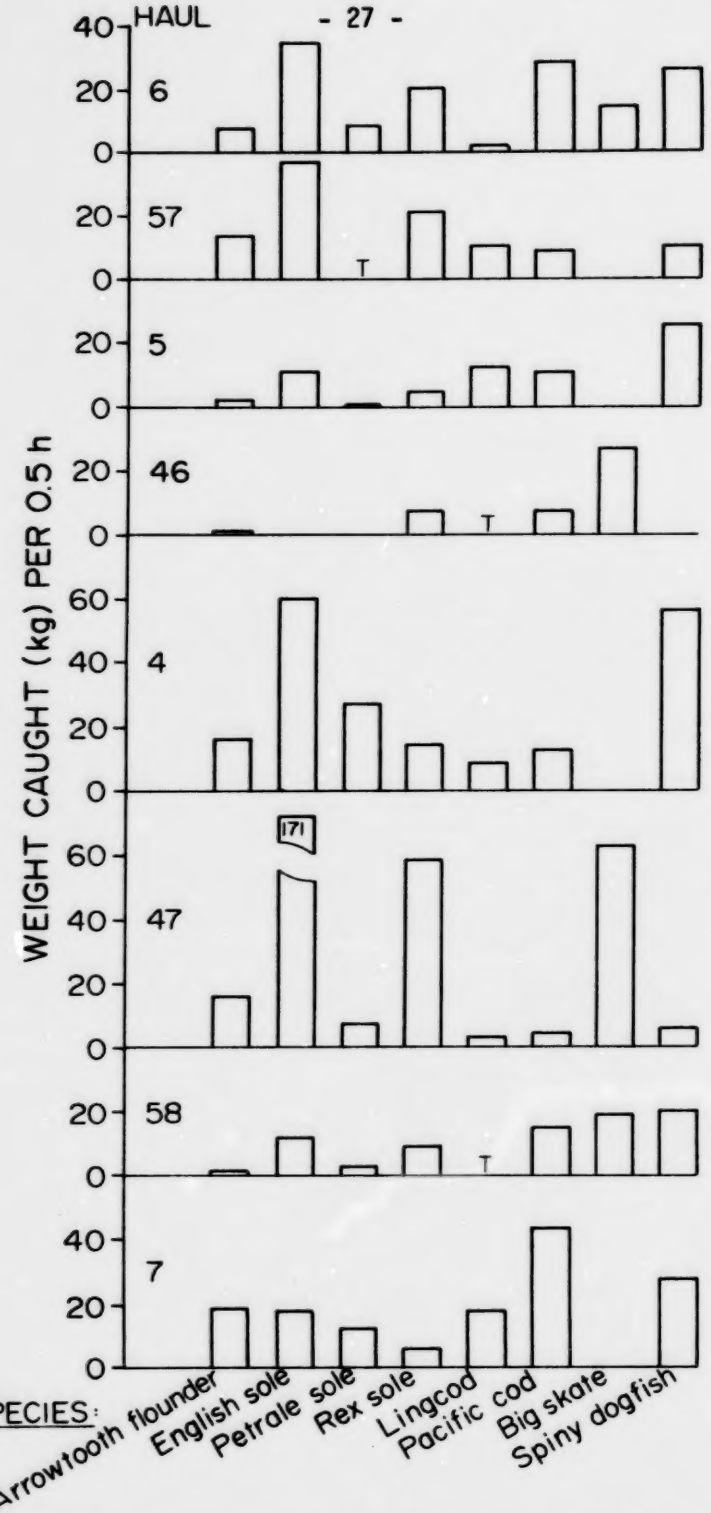

Fig. 5. Weight (kg) caught per haul (standardized to 30 min) for eight major species (86.7% of catch) caught in eight hauls in the southern portion of block H4 during the cruise of the FRV G.B. REED to Hecate Strait, January 27 - February 18, 1986.

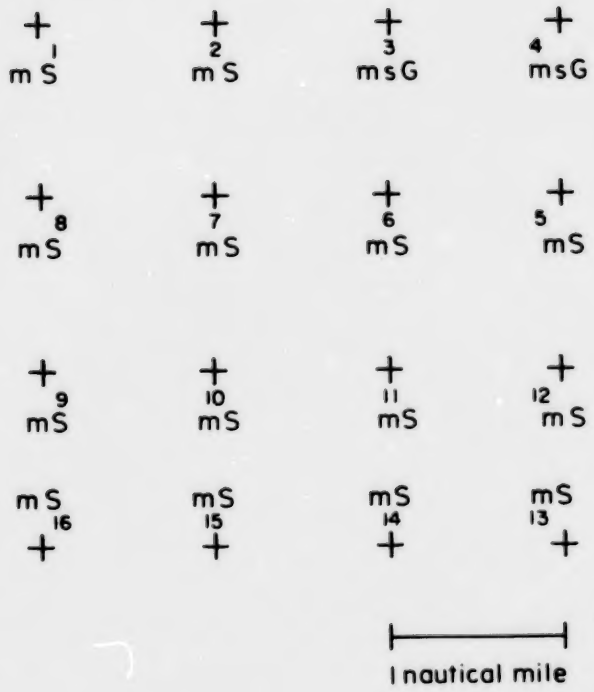

Fig. 6. Particle-size composition and locations of sediment-grab sites in trophic-study area D occupied during the cruise of the FRV G.B. REED to Hecate Strait, January 27 - February 18, 1986. (See figure 2 and appendix table 7). (Particle-size codes: G = gravel, m = muddy, s = sandy, S = sand. Capital letters indicate dominant particle size).

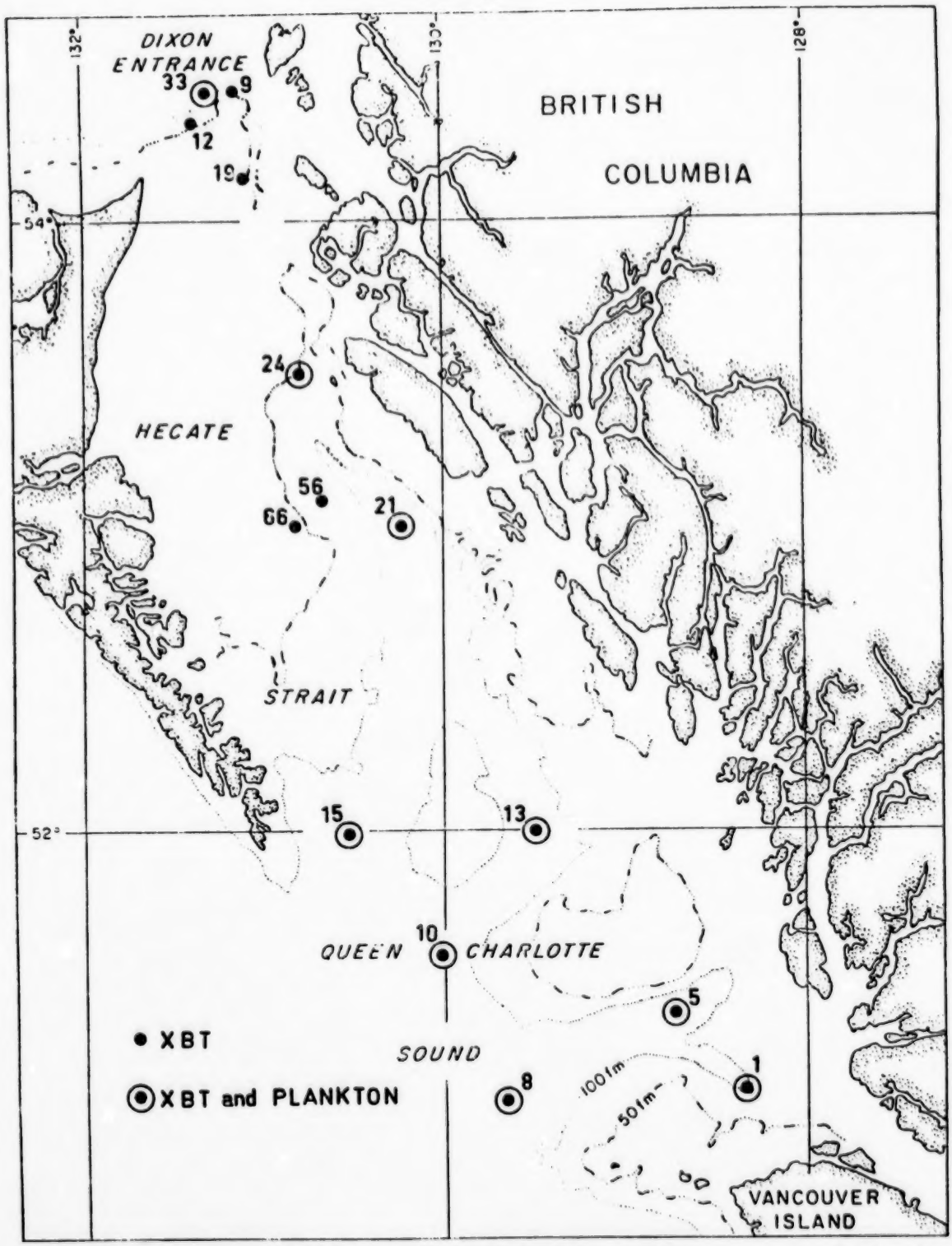

Fig. 7. Locations of hydrographic and plankton stations occupied during the cruise of the FRV G.B. REED to Hecate Strait, January 27 - February 18, 1986.

Appendix Table 1 through Appendix Table 9 do not appear in paper, but appear in microfiche form at the back of this report.